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AUTHOR Bellows, B. P.
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ABSTRACT

This study examined the task performance and social interaction of young children who used a computer to learn map skills. Specifically, ability and sex were examined in relation to students' achievement on a social studies task and in relation to student interaction in small groups. Subjects were 66 second grade students in 3 different classrooms. A total of 28 boys and 27 girls were assigned to dyadic or triadic treatment conditions. Results indicated that students in mixed-ability triads had significantly greater gains in achievement than students in uniform-ability groups, that boys and girls did equally well on the task, high-ability students were dominant in group interaction, and subjects most freqently gave and received terminal responses and rarely gave explanations. It is concluded that ability has a bearing on student interaction and achievement in small group computer learning situations. (RH)

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WHAT MAKES A TEAM?:THE COMPOSITION OF SMALL GROUPS FOR C.A.I.

B. P. Bellows

Fairfax County Public Schools

The computer has reached into many classrooms as an adjunct to the teacher's instruction. As a consequence, students are often grouped around the computer. This study examined the interaction of young children who were using the computer to learn map skills. The independent variables of ability and sex were examined in relation to the students' achievement on the social studies task and in relation to student interaction in the small groups.

Theoretical Framework

Student characteristics have a significant impact on what occurs in small groups (Hallinan, 1984). For example, both sex and ability have been examined in relation to the interaction between group members as well as in relation to students' achievement.

Webb (1980, 1982b) found that the composition of small groups in terms of ability levels had a significant bearing on the achievement of the individual students. Using a junior high school population she found that mixed-ability groups with high and medium-ability students or with medium and low-ability students had higher achievement than uniform-ability groups. Students of medium-ability tended to be left out of the group interaction when they were in groups which included high and low ability students.

With second and third grade children, Spinelli and Wilkinson (1983) found a positive relationship between mathematical achievement

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and two student behaviors: (1.) asking for direct help from a peer, and (2.) receiving appropriate responses to requests. In similiar studies across grades (first, second, third), content (reading and math), and with both mixed-ability and uniform-ability groups, they found similiar results. The Spinelli and Wilkinson model explains that these young school-age children speak explicitly, directly, and assertively when in small groups. This is in contrast with the speaking patterns typically associated with adults, who are more concerned with cooperation and politeness.

In a meta-analysis of 64 sets of small-group data, Lockheed (1984) found that men usually assumed the leadership positions in mixed-sex groups. An earlier review of research on mixed-sex discussion groups led Lockheed et al. (1976) to conclude that, in mixed-sex groups, men were more verbally active and more influential than women.

Webb (1984) found that, in a study of small group mathematics learning for grades seven and eight, males had greater achievement than females even though females and males had similar ability. When inspecting the verbal interaction in the small groups, she found that nearly two-thirds of the females' requests for explanations went unanswered, whereas only one third of the males' requests for explanations went unanswered. Similarly, the females had many more unanswered procedural questions. Although the quantity of verbalizations was similar for males and females, there was a difference between the types of verbalizations. Webb concluded that male students experienced most of the interaction that was beneficial for achievement (receiving explanations) while female students experienced most of the interaction that was detrimental for

achievement (receiving no explanations).

Research Questions

By focusing on a younger population, the study reported here attempted to extend Webb's approach to looking at group interaction. The following questions were addressed:

In small group computer learning

(a) Is there a relationship between sex and achievement?

(b) Is there a relationship between ability and achievement?

(c) Is there a relationship between sex or ability and who dominates or is left out of a group?

(d) Are the types of student interactions in this computer learning activity similar to those observed in other small group settings?

Methods

Subjects. A large suburban school district was the site of the study. Subjects were sixty-six second grade students in three different classrooms. Twenty-eight boys and twenty-seven girls were assigned to pair or triad treatment conditions.

A current standardized test of ability was not available for the subjects of this study. Thus, ability was defined as the student's reading ability and was determined by the classroom teacher's rating of each student.

Procedures. The children were randomly assigned to work alone, in pairs, or in triads. Within their assigned groups, all students completed a computer-assisted instruction (C.A.I.) program on social studies map skills (the cardinal and intermediate directions) and then practiced application of the skills by playing a computer game. Students were instructed to "take turns" when using the computer.

Data analysis

This study required a one-way analysis of covariance pretest/posttest design with achievement as the dependent variable. Every subject was given a pretest and an equivalent form posttest specifically designed for this study. Internal consistency of the test items for each of the two forms of the test was established using Cronbach's Alpha (Pretest Form A .83; Pretest Form B .80; Posttest Form A .75; Posttest Form B .80) An item analysis showed that all of the test items adequately discriminated. Test-retest reliability was established using 36 second-graders who were not involved in the study.

All verbal interaction was audiotaped while the observer took note of non-verbal behavior. The coding protocol which was developed for this study was tailored to the interactions of these particular students, although it was similar to Webb's (1982a, 1982b, 1984a, 1984b, 1984c) coding scheme.

Many subcategories of behavior were needed to describe what occurred in the groups, but only the four major categories were used in the statistical calculations: "Receives an explantion on content", "Gives help on content", "Receives no explanation on content", and "All procedural help". "Procedural help" included asking for, giving, and receiving assistance on using the computer, reading the directions, or spelling.

At four points in the session, student interaction was analyzed for who was dominant or left out of the group interaction. The percentage of agreement between the two independent raters of this qualitative aspect of the data was 81%.

For twenty-five of the students, who were randomly selected,

verbatim transcripts were compiled, coded according to the protocol in Table 1, and tallied. The percentage of agreement between two independent raters of the coding of each verbalization was 83%.

Table 1

Coding Protocol

FOR MAP SKILLS CONTENT:RECEIVES AN EXPLANATION

1.makes an error, receives an explanation

2.asks for and receives an explanation

FOR MAP SKILLS CONTENT:GIVES HELP

1.gives only an answer

2 gives an explanation with an answer

FOR MAP SKILLS CONTENT:RECEIVES NO EXPLANATION

1.makes error or does nothing, is not corrected

2.makes error or does nothing, receives answer without explanation

3.asks for help, receives no help

4.asks for help, receives only the answer but no explanation

5.makes error, receive computer feedback only("That is not right. Try again.")

FOR PROCEDURE--EITHER ON HOW TO USE THE COMPUTER OR HOW TO ANSWER A QUESTION(including spelling or word recognition)

1.gives help

2.asks for help, receives no help

3.asks for help, receives help(including his/her own problem-solving)

4.receives help without requesting it.

Results

The children did learn the skill from the C.A.I. tutorial. A dependent t-test for examining the students' pretest scores compared to their posttest scores showed that they made gains which were significant at the .001 level.

Is there a relationship between sex and achievement?

The Pearson Correlation indicated that there was some relationship between sex and the pretest, although on the posttest the relationship was not significant. Thus, whether one is a girl or boy does not seem to affect achievement as measured by the posttest. The results are reported in Table 2.

Using the pretest as a covariate when calculating an analysis of covariance confirmed that there was no significant relationship between sex and achievement.

Table 2

Correlation Coefficients for Ability, Sex, Pretest, and Posttest

	n	Pretest	Posttest
Ability	66	.56*	.46*
Sex	66	.22**	.16

*p<.001 **p<.05

Is there a relationship between ability and achievement?

Ability significantly correlated with both pretest (r=.56. p<.001) and posttest (r=.46, p<.001).

Furthermore, for triads, but not for pairs, students in mixed-ability groups had significantly greater achievement gains than students in uniform-ability groups.

Is there a relationship between sex or ability and who dominates or is left out of the group interaction?

To see if one student was consistently dominant or consistently left out of the group interaction, the data were analyzed at four specific points in the C.A.I. session. Table 3 reports results for all of the groups. In nine of the twenty-two groups one student was dominant. In all of those cases, the dominant group member had the highest ability level in the group.

Where one child was dominant in a mixed-sex group, five out of six times it was a boy who was dominant; in only one group where there were both girls and boys did a girl take the lead.

Sometimes, in groups of three, one person is consistently left out. This was true in four of the eleven groups. In one group, the "odd man out" was a poor reader, who was formally labelled "learning-disabled"; perhaps the other girls considered her inferior because of this. This girl, as well one other "odd man out" made great efforts to be included in the group interaction; neither achieved status as an equal in the group. Two other "odd men out" were accepted by their groups to some degree,

Table 3.

Compositions of the Groups, Dominance & Odd-Man-Out

Group	Size	Sex	Ability	Dominance	Odd-Man-Out
1	2	m,m	2,3	m2	
2	2	m,f	3,1		
3	2	f,f	1,3	f1	
4	2	m,f	3,3		
5	2	f,f	3,3		
6	2	f,m	3,1		
7	2	f,m	2,2		
8	2	f,f	2,3		
9	2	f,m	3,1	m1	
10	2	f,m	2,2	m2	
11	2	m,m	3,3		
12	3	f,f,m	3,3,3	f3	m3
13	3	f,m,m	3,2,1		
14	3	m,m,m	1,1,2		
15	3	f,f,m	1,1,2		
16	3	m,f,f	2,3,3		
17	3	m,f,m	1,3,3	m1	m3
18	3	f,m,f	3,3,1		
19	3	m,f,m	2,2,2	m2	
20	3	m,m,m	2,2,2		
21	3	f,f,f	1,3,1		f3
22	3	f,m,m	1,1,1	m1	m1

Types of Interaction

Among the twenty-five children whose interactions were analyzed verbatim, there were 217 "Giving help" interactions. The number of responses ranged from one student who gave 2 to another student who gave 17. For all types of "Procedural" interactions, there were a total of 511 interactions, with the number of responses ranging from 6 to 42. Positive correlations between the four categories of interaction suggest that those students who were active participants in the group tended to be active in all kinds of interactions.

One type of behavior (receiving only an answer but not an explanation) was coded two different ways: first it was subsumed under the category of "No explanation" as Webb had done; later it was changed to be included under the category of "Receives an explanation". This was for the purpose of exploring whether that behavior (receiving a terminal response) correlated with achievement or other dependent variables. It made no difference whether receiving only an answer was grouped with "Receiving an explanation" or with "No explanation given"; there were no significant correlations between any of the categories of behavior and posttest or gain scores. This is in contrast to Webb's findings across her five major studies which included more than 350 students across a variety of grade levels (1985). She found that receiving a terminal response was negatively related to achievement but that receiving an explanation was positively related to achievement.

The subjects of this study rarely gave or received explanations. Most giving of assistance on content was in the form of terminal responses.

Discussion and Implications

Ability and Sex in Relation to Achievement

Ability and achievement. Students in small groups do best if they represent a variety of ability levels (Hallinan, 1984). This study found that for triads, but not for pairs, students in mixed-ability groups had significantly greater gains in achievement than students in uniform-ability groups. Webb (1980,1982a,1982b) did not use pairs in her studies of small groups for mathematics lessons. Thus, our findings concur with Webb's yet raise more questions: Under what conditions is the composition (in terms of ability) of the pairs significant? What happens in the groups of three that make uniform-ability groups less functional for students' achievement? These questions need to be asked in studies that provide a larger number of groups.

Sex and achievement. The quantitative data showed that boys and girls did equally well on this computer assignment. Even though boys were more often dominant, achievement was similar for boys and girls. This is an encouraging bit of information. Although for their older brothers and sisters sex may be a factor for learning via computers, these youngsters are still free from sex-role stereotyping in computer learning. It is hoped that other studies will confirm this finding.

Student Interaction in Small Groups

Dominance. As computer use in schools expands, small group instruction may very well increase also. Thus, understanding the social ramifications for students is important. High-ability students were dominant in group interaction. Academic competence, then, connects to social confidence in small group learning settings. In one group, though, a shy high-ability boy did not dominate his

lower-ability peers; they had more social skills (were "street-wise"). Males were more often dominant, a finding that is consistent with Lockheed's (1976, 1984) work.

The odd man out phenomenon. Further study needs to be made in order to elucidate which students end up being "odd men out", under what conditions they can rehabilitate themselves, and under what conditions they do not rehabilitate themselves. Are there skills, such as assertivesness training, that these students could utilize to increase their participation.

Giving & receiving explanations. Webb (1982c, 1985) has presented convincing arguments that giving and receiving explanations rather than giving and receiving terminal responses are an advantage to students' learning. The subjects of this study rarely gave or received explanations probably because they do not yet possess sufficient verbal competence. This is a clue regarding the ideal age for successful peer-led small group learning.

Probably because they do not yet possess sufficient verbal skills, the students in this study gave and received mostly terminal responses rather than explanations. This is a contribution to a line of research which has begun to examine metacognitions and communicative competence in relation to age. It is consistent with Wilkinson and Spinelli's (1983) model in that the students were very direct and explicit in the information they exchanged.

Further research could investigate (a) the developmental stage when students can successfully offer explanations in small group settings; (b) whether modeling of explanations by a teacher results in students being able to offer their peers comprehensive explanations rather than only terminal reponses; (c) whether there are more or

fewer terminal responses versus explanations as a group develops over time.

Procedural help. The category of procedural help included asking, giving, and receiving help of several different types. For some of the subjects reading the text or spelling the answers to be typed in (usually just copying the answers from the screen) were very time-consuming and interaction-rich activities. Further research may explore the different elements of this category: (a) reading text, (b) following directions to complete the C.A.I. task, (c) using the computer, especially utilizing the keyboard, (d) spelling words to be typed in, (e) asking for versus receiving versus giving procedural help. It may be useful in future research to divide the procedural category.

Conclusion

Ability does have a bearing on student interaction and achievement in small group computer learning. Boys were more often dominant in group discussion but sex had no bearing on achievement. This study continued the examination of small group interaction, its findings contrasting and, at other times, concurring with the findings of other researchers.